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PATENT ABSTRACTS OF JAPAN

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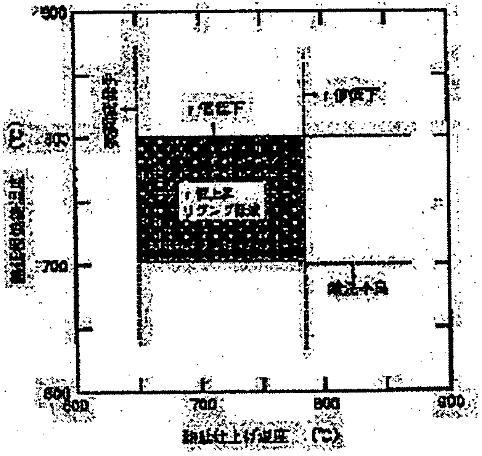
(54) PRODUCTION OF HIGH CHROMIUM COLD ROLLED STEEL STRIP EXCELLENT IN RIDGING RESISTANCE AND WORKABILITY AND PRODUCTION OF HOT ROLLED STEEL STRIP FOR THE SAME STOCK

(57)Abstract:

PURPOSE: To provide a method for producing a high chromium cold rolled steel strip (including steel sheet) small in the generation of ridging and excellent in workability.

CONSTITUTION: The continuously cast slab of a high chromium steel contg., by weight, 0.01 to 0.08% C, 0.1 to 0.5% Si, 0.4 to 1% Mn, 15 to 19% Cr, 0.25% Ni, &le;0.25% Mo, &le;0.25% Cu, &le;0.25% V, 0 to <0.01% sol.Al and 0.005 to 0.08% N is subjected to hot rolling under the conditions of 1100 to 1250° C heating temp., 650 to 780° C hot rolling finishing temp. and &le;65° C coiling temp. to obtain a hot rolled steel strip, and this steel strip is subjected to annealing under the annealing conditions of 700 to 800° C annealing temp. and 0.1 to 8min annealing time, is subjected to pickling and is subjected to cold rolling and annealing- pickling.



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CLAIMS

[Claim(s)]
[Claim 1] It is C at weight %. : 0.01 - 0.08%, Si:0.1-0.5%, Mn:0.4-1%, Cr: 15-19%, less than [nickel:0.25%], less than Mo:0.25%], Cu: Less than [0.25%], V:0.25% or less, less than [Sol.aluminum:0-0.01%], The continuous casting slab of the high chrome steel containing N:0.005 - 0.08% The heating temperature of 1100-1250 degrees C, 650-780 degrees C of hot-rolling finishing temperature, It hot-rolls on conditions with a rolling-up temperature of 650 degrees C or less, and a hot-rolling steel strip is obtained. this steel strip 700-800 degrees C of annealing temperatures, The manufacture method of a high chromium cold-rolled steel strip of having annealed continuously on the annealing conditions which consist of annealing time 0.1 - 8 minutes, having performed pickling further, and having excelled in the RIJINGU-proof nature which carries out pickling or is characterized by cold rolling, annealing, and performing temper rolling further, and processability succeedingly depending on the case.
[Claim 2] It is C at weight %. : 0.01 - 0.08%, Si:0.1-0.5%, Mn:0.4-1%, Cr: 15-19%, less than [nickel:0.25%], less than Mo:0.25%], Cu: Less than [0.25%], V:0.25% or less, less than [Sol.aluminum:0-0.01%], The continuous casting slab of the high chrome steel containing N:0.005 - 0.08% The heating temperature of 1100-1250 degrees C, 650-780 degrees C of hot-rolling finishing temperature, It hot-rolls on conditions with a rolling-up temperature of 650 degrees C or less, and a hot-rolling steel strip is obtained. this steel strip 700-800 degrees C of annealing temperatures, The manufacture method of the hot-rolling steel strip for high chromium cold-rolled steel strip materials excellent in the RIJINGU-proof nature characterized by annealing continuously on the annealing conditions which consist of annealing time 0.1 - 8 minutes, and performing pickling further, and processability.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention offers the manufacture method in a low cost, when RIJINGU generating continuation-izes annealing of a hot-rolling steel strip about the manufacture method of a high chromium cold-rolled steel strip (included steel plate) of having excelled in processability few, and the manufacture method of the hot-rolling steel strip for the materials.
[0002]
[Description of the Prior Art] It excels in the processability by the continuous-annealing process of a hot-rolling steel strip, and JP,3-48250,B, JP,60-24325,A, and JP,59-43978,B can be mentioned about the manufacture method of a high-chrome-steel band with little RIJINGU generating.
[0003] Using the distorted storage effect by the bottom of hot-rolling pressure, JP,3-48250,B promotes organization detailed-ization by the recrystallization at the time of continuous annealing of a hot-rolling steel strip, and raises RIJINGU-proof nature. Although it was targeting the ferritic stainless steel at large, this technology contained aluminum 0.02 to 0.2% substantially, had generating of a surface crack, had proposed making it high Mo by the case, and had a problem in respect of cost.
[0004] moreover, it finishes and is made to perform 800 degrees C or less and 700-1100 degrees C of hot-rolling steel strip annealing for the rolling temperature in the latter part of hot rolling with this technology at 900-1100 degrees C preferably however — if a ferritic stainless steel is generally annealed at the elevated temperature of 900-1100 degrees C — a martensitic phase — generating — the time of pickling — surface deterioration — starting — a front face — a character deteriorates
[0005] JP,60-24325,A did not have addition of V, had the problem of processability, did not have addition of Mo and Cu, either, and was a problem in respect of corrosion resistance. from moreover and its example — substantial — hot-rolling finishing temperature — 780 degrees C or more — and hot-rolling steel strip annealing — 900-950 degrees C — carrying out — **** — this sake — an average of r values of the index of processability — low — and the time of pickling — surface deterioration — starting — a front face — it was that in which a character deteriorates Moreover, it was what the indication of the winding temperature of hot-rolling does not have, either.
[0006] Although RIJINGU-proof nature is improved, since 0.01 - 0.2% of aluminum is added with the combination of hot-rolling conditions and hot-rolling steel strip annealing conditions, there is generating of a surface crack, there was no addition of V, there was a problem of processability, there was also no addition of Mo and Cu, and JP,59-43978,B was also a problem in respect of corrosion resistance.
[0007] the indication of the finishing temperature of moreover and hot-rolling, and winding temperature — there is nothing — further — substantial — hot-rolling steel strip annealing — 850-900 degrees C — carrying out — **** — this sake — an average of r values of the index of processability — low — and the time of pickling — surface deterioration — starting — a front face — it was that in which a character deteriorates
[0008]
[Problem(s) to be Solved] There is also no surface deterioration at the time of a surface crack and pickling, and manufacturing cheaply the high chromium cold-rolled steel strip excellent in RIJINGU-proof nature and processability was called for strongly.
[0009]
[Means for Solving the Problem] The 1st invention is C at weight %. : 0.01 - 0.08%, Si:0.1-0.5%, Mn: 0.4-1.0%, Cr:15-19%, less than [nickel:0.25%], Mo: Less than [0.25%], less than [Cu:0.25%], V:0.25% or less, Less than Sol.aluminum:0-0.01%] and the continuous casting slab of the high chrome steel containing N:0.005 - 0.08% The heating temperature of 1100-1250 degrees C, 650-780 degrees C of hot-rolling finishing temperature, It hot-rolls on conditions with a rolling-up temperature of 650 degrees C or less, and a hot-rolling steel strip is obtained. this steel strip 700-800 degrees C of annealing temperatures, It is the manufacture method of a high chromium cold-rolled steel strip of having excelled in the RIJINGU-proof nature which anneals continuously on the annealing conditions which consist of annealing time 0.1 - 8 minutes, performs pickling further, and is characterized by cold rolling, annealing, and carrying out pickling or performing temper rolling further depending on the case, and processability succeedingly.
[0010] The 2nd invention is C at weight %. : 0.01 - 0.08%, Si:0.1-0.5%, Mn: 0.4-1%, Cr:15-19%, less than [nickel:0.25%], Mo: Less than [0.25%], less than [Cu:0.25%], V:0.25% or less, Less than [Sol.aluminum:0-0.01%] and the continuous casting slab of the high chrome steel containing N:0.005 - 0.08% The heating temperature of 1100-1250 degrees C, 650-780 degrees C of hot-rolling finishing temperature, It hot-rolls on conditions with a rolling-up temperature of 650 degrees C or less, and a hot-rolling steel strip is obtained. this steel strip 700-800 degrees C of annealing temperatures, It is the manufacture method of the hot-rolling steel strip for high chromium cold-rolled steel strip materials excellent in the RIJINGU-proof nature characterized by annealing continuously on the annealing conditions which consist of annealing time 0.1 - 8 minutes, and performing pickling further, and processability.
[0011]
[Function] this invention makes the whole composition exquisite conditions, in order to manufacture cheaply the high chromium cold-rolled steel strip excellent in RIJINGU-proof nature and processability, preventing the increase in the surface deterioration at the time of a surface crack and pickling.
[0012] Below, the component (% of the weight) of this invention and the reason for limitation of manufacture conditions are explained.

[0029] On the other hand, if an annealing temperature is less than 700 degrees C, although it will not illustrate, pickling nature falls, and it becomes easy to generate the surface discontinuity by scale remains. Therefore, an annealing temperature makes 700-800 degrees C preferably 700-790 degrees C.

[0030] Moreover, as shown in drawing 3, the way of RIJINGU-proof nature which reduced N improves. Therefore, N content has a desirable low way.

[0031] Hot-rolling steel-strip (board) annealing time: When annealing time is as short as less than 0.1 minutes, sufficient recovery does not take place and disassembly of the 2nd hard phase which is still hot-rolling and exists does not take place, either. In this case, since good processability is not acquired, annealing time is made into 0.1 minutes or more. If annealing time becomes long, productive efficiency will fall and a manufacturing cost will increase. In the case of the object steel of this application, disassembly of the 2nd hard phase which is still sufficient recovery of a host phase and hot-rolling, and exists by annealing by 8 minutes takes place, and the processability after cold-rolled annealing is raised. Therefore, annealing time is made into 0.1 - 8 minutes.

[0032] As component composition of this invention, otherwise, even if it adds calcium, Ti, Nb, Zr, etc. further as occasion demands, it is a book.

[0033] this invention contains the hot-rolling steel strip to pickling to continuous annealing to hot-rolling including the manufacture method of the hot-rolling steel strip for the materials of a high chromium cold-rolled steel strip. Furthermore, in order to obtain predetermined surface finish and the more excellent shape property, it includes carrying out temper rolling or tension leveler processing after pickling of a hot-rolling steel strip, or carrying out coil grinder processing.

[0034] Similarly, in order to acquire predetermined surface finish, the more excellent shape property, and a mechanical property, it includes carrying out temper rolling or tension leveler processing after pickling of a cold-rolled steel strip, or carrying out coil grinder processing.

[0035]

[Example] The example of this invention is described below. Steel 1-5 of a chemical composition shown in Table 1 which ingoted, cast and obtained the high chrome steel Hot-rolling, hot-rolling steel strip annealing, and cold-rolled steel strip annealing were performed on the conditions shown in Table 2. An average of r values and RIJINGU height were measured after cold-rolled annealing. An average of r values are the averages of the r value of three directions of a rolling direction, the rolling right-angled direction, and the 45 rolling direction, and are defined by the formula 1. An average of r values = (r0+r90+2r45)/4 Formula 1 It is rx here. A rolling direction to x The r value of the direction of a degree is expressed.

[0036]

[Table 1]

① 鋼番	C	Si	Mn	Cr	Ni	Mo	Cu	V	Sol.Al	N	② 備考
1	0.030	0.41	0.75	15.40	0.14	0.15	0.11	0.18	0.002	0.035	
2	0.070	0.20	0.41	18.50	0.05	0.10	0.11	0.06	0.008	0.007	
3	0.050	0.30	0.95	16.40	0.12	0.06	0.05	0.08	0.005	0.076	
4	0.060	0.30	0.50	16.40	0.11	0.06	0.05	0.09	0.003	0.008	
5	0.060	0.26	0.54	16.60	0.08	0.08	0.06	0.04	0.003	0.030	
D	0.06	0.45	0.45	17.60	—	—	—	—	0.030	0.013	発明範囲外 ③
A	0.054	0.35	0.30	17.40	—	—	—	—	0.020	0.010	発明範囲外 ③

① Steel No.
② remarks
③ out of this invention

[0037] RIJINGU height measured the granularity of the front face at the time of making a steel strip deform plastically 15% with the granularity plan.

[0038] A result is collectively shown in Table 2. An average of r values are 1.0 or more, and the steel strip manufactured on the conditions by this invention is as small [RIJINGU height] as 6.5 micrometers or less. moreover — this invention — a front face — the character was also good

[0039] On the other hand, for the steel strip manufactured without taking the conditions of this invention, an average of r values are 1.0. It did not reach and what has high RIJINGU height has increased.

[0040] Conditions A1-A4 are JP,3-48250,B quoted as conventional technology. A of Table 1 indicated by the example and Table 3 And D It is as a result of the steel strip which carried out hot-rolling and annealing and obtained the steel which has composition on condition that Table 2 and Table 4. JP,3-48250,B It sets and is a steel plate D. And A It is shown as an example of a type of a ferritic stainless steel. However, since the balance of a component — 0.02 - 0.03% of aluminum is contained in those steel — and manufacture conditions is bad, it is which poor cold-rolled steel strip of an average of r poor value, poor RIJINGU height, and a surface crack which is easy to generate.

[0041]

[Table 2]

① 条件	② 鋼番	③ 区分 ⑬	④ 加熱温度 (℃)	⑤ 仕上げ温度 (℃)	⑥ 巻取り温度 (℃)	⑦ 熱延板焼鈍温度 (℃)	⑧ 熱延板焼鈍時間 (分)	⑨ 冷延板焼鈍温度 (℃)	⑩ r値	⑪ リジング高さ (μm)	⑫ 備考
1	1	本発明例	1200	775	630	800	2	830	1.08	5.2	
2	1	本発明例	1230	750	610	800	1.5	840	1.10	6.3	
3	1	本発明例	1180	700	620	785	2.5	820	1.05	6.2	
4	2	本発明例	1150	660	600	750	3	880	1.01	3.7	
5	2	本発明例	1120	720	630	720	3	900	1.18	4.2	
6	3	本発明例	1220	740	580	790	2	845	1.10	5.8	
7	3	本発明例	1110	690	570	710	4	820	1.07	3.4	
8	4	本発明例	1240	730	620	750	5	860	1.17	5.8	
9	4	本発明例	1200	670	590	715	5	850	1.03	5.0	
10	5	本発明例	1110	655	530	780	3	830	1.02	2.0	
11	5	本発明例	1180	715	580	760	5	820	1.09	4.9	
12	5	本発明例	1240	770	620	750	5	820	1.16	6.2	
13	1	比較例	1200	940	830	750	3	840	0.71	8.9	
14	1	比較例	1150	880	630	850	2	840	0.80	9.4	
15	2	比較例	1240	780	700	650	6	850	0.90	8.0	酸洗不良 ⑮
16	2	比較例	1200	850	610	830	2	870	0.75	4.4	
17	3	比較例	1150	820	630	780	3.5	850	0.86	5.0	
18	3	比較例	1120	720	610	880	2.5	840	0.72	4.8	
19	4	比較例	1200	740	700	770	5	880	0.81	7.9	
20	4	比較例	1280	780	630	720	6	860	0.98	10.3	
21	5	比較例	1200	900	610	880	1.5	850	0.72	5.4	
22	5	比較例	1150	810	630	780	2	830	0.80	6.8	
23	5	比較例	1180	740	580	850	3	820	0.78	4.9	
A1	D	〃	1100	800		800	5	840	1.10	10	表面疵 ⑯
A2	D	〃	1100	700		800	5	840	1.16	7	〃 ⑯
A3	A	〃	1100	650		950	2	850	1.04	3	酸洗不良 ⑮
A4	A	〃	1100	650		950	2	850	1.02	4	〃 ⑮

⑭

[0042]
[Effect of the Invention] According to this invention, RIJINGU generating becomes possible [manufacturing cheaply the high chromium cold-rolled steel strip which was excellent in processability few, and the hot-rolling steel strip of the material] by adjusting the addition of the basic content element of a high chrome steel to a subject, and specifying hot-rolling and hot-rolling steel strip annealing conditions.

[Translation done.]

① condition
② steel No.
③ examples
④ heating temp. (°c)
⑤ hot finish rolling temp. (°c)
⑥ coiling temp. (°c)
⑦ hot annealing temp. (°c)
⑧ hot annealing time (min.)
⑨ cold annealing temp. (°c)
⑩ r-value
⑪ ridging (RIJINGU) height (μm)
⑫ remarks
⑬ example of this invention
⑭ compartive examination

⑮ incomplete pickling
⑯ surface defects

C: Since it will become easy to make it hard if C has big influence on the mechanical property of a high chrome steel and it exceeds 0.08%, it makes 0.08% an upper limit. Conversely, at less than 0.01%, it becomes easy to generate RIJINGU. Steel-manufacture cost of reduce [to less than 0.01 more% / C] will also increase, and the economical merit of a high chrome steel of it is lost. Therefore, you may be 0.01 - 0.08%.
[0013] Si:Si is 0.1% or more need because of deoxidation. If it exceeds 0.5%, since the ductile fall after cold-rolled annealing will be caused, let 0.5% be an upper limit.
[0014] Mn:Mn is an austenite formation element, in less than 0.4% of addition, has few amounts of generation of the austenite phase under hot-rolling, and cannot expect reduction of RIJINGU. Moreover, 0.4% or more is required also because of deoxidation. When it adds exceeding 1%, a hot-rolling steel strip hardens, it is hard to soften at the time of continuing short-time annealing, and trouble may be caused to cold-rolling. Therefore, Mn may be 0.4 - 1%.
[0015] Cr:Cr is an indispensable element in order to secure the corrosion resistance of a high chrome steel. At less than 15%, it is inferior to corrosion resistance, and also a hot-rolling steel strip hardens, it is hard to soften at the time of continuing short-time annealing, and trouble may be caused to cold-rolling. If it adds exceeding 19%, although corrosion resistance is enough, RIJINGU will become easy to generate it. Therefore, Cr may be 15 - 19%.
[0016] nickel:nickel is an austenite formation element and is effective in reduction of RIJINGU. However, if it adds exceeding 0.25%, after hot-rolling coil annealing, a hard phase will remain so much and will cause surface surface deterioration at the time of pickling. Moreover, the RIJINGU reduction effect is also saturated. Therefore, nickel is made into 0.25% or less.
[0017] Mo:Mo is an element which raises the corrosion resistance of a high chrome steel. However, Mo is an expensive element and the addition exceeding 0.25% brings about elevation of material cost. One of the purposes of this invention is manufacturing cheaply the high chrome steel which has the outstanding property, and addition of superfluous Mo is not suitable for the purpose of this invention. Therefore, Mo may be 0.25% or less.
[0018] Cu:Cu is an element which raises the corrosion resistance of a high chrome steel. However, Cu is an expensive element and the addition exceeding 0.25% brings about elevation of material cost. Therefore, since it is the same as that of Mo, Cu may be 0.25% or less.
[0019] In order that V:V may fix C and N as a charcoal nitride and may reduce C in a host phase, and N, an effect is in improvement in processability. However, the effect is saturated even if it adds exceeding 0.25%. Therefore, V may be 0.25% or less.
[0020] Sol.aluminum:aluminum is a powerful deoxidizer. However, when it is easy to form an on the other hand very hard spherical oxide and this appears in a front face, it becomes the cause of generating of a surface crack. Therefore, you may be less than 0 - 0.01% as Sol.aluminum.
[0021] Moreover, RIJINGU height can be reduced to 6.5 micrometers or less which does not pose a problem practically by making Sol.aluminum into less than 0.01%, and performing a hot-rolling steel strip annealing temperature at 700-800-degree C low temperature. The high chromium cold-rolled steel strip of good quality can be manufactured aiming at energy saving and suppressing a manufacturing cost by this.
[0022] N: N has big influence on the mechanical property of a high chrome steel like C. Since it will become easy to make it hard if it exceeds 0.08%, let 0.08% be an upper limit. On the other hand, it is N a sake [on a RIJINGU-proof disposition]. Although it is better to decrease, reducing N to less than 0.005% will increase steel-manufacture cost, and the economical merit of a high chrome steel of it is lost. Therefore, N may be 0.005 - 0.08%.
[0023] Hot-rolling heating temperature: In order to hold an organization more minutely for RIJINGU reduction, heating temperature has a good low way. However, problems which heating temperature cannot roll out to predetermined board thickness by the load at the time of hot-rolling becoming high at less than 1100 degrees C, such as generating of the surface crack by rolling load increase, arise. Conversely, if it exceeds 1250 degrees C, big and rough-ization of an organization will take place during heating, and RIJINGU will come to appear notably. Moreover, since steel becomes soft, curvature is produced during heating in the self-weight of slab, and rolling becomes impossible. Therefore, hot-rolling heating temperature is made into 1100-1250 degrees C.
[0024] Although the result which processed the steel of the above-mentioned specific component range which is one of the features of the invention in this application according to various kinds of hot-rolling finishing temperature and hot-rolling steel strip (board) annealing conditions is shown in drawing 1, it turns out that the high chromium cold-rolled steel strip excellent in RIJINGU-proof nature and processability can be manufactured by making it the range of this invention, preventing the surface deterioration at the time of a surface crack and pickling.
[0025] Hot-rolling finishing temperature: Hot-rolling finishing temperature influences greatly the RIJINGU-proof nature after cold-rolled annealing, and processability. 16.4%, finishing temperature is changed, the high chrome steel which has within the limits 0.06%C of this invention, 0.3%Si, 0.5%Mn, and Cr, 0.003%Sol.aluminum and the composition that consists of N 0.03% is hot-rolled, and drawing 2 is 3 at 790 degrees C. Between parts, 720 degrees C — 3 a part — between — the relation between the hot-rolling finishing temperature and the r value at the time of performing hot-rolling steel strip (board) annealing, and performing 75 more% of cold rolling and the last annealing, and RIJINGU height is shown If hot-rolling finishing temperature is less than 780 degrees C as shown in drawing 2, an average of r values which are the indexes of processability will improve sharply, and the outstanding property comes to be shown. However, if hot-rolling finishing temperature is less than 650 degrees C, the load of hot-rolling will increase and it will become easy to generate a crack on a front face. Therefore, hot-rolling finishing temperature may be 650-780 degrees C.
[0026] Rolling-up temperature: In order that rolling-up temperature may accumulate distortion by low-temperature hot-rolling and may suppress the recovery after rolling up, make it into 650 degrees C or less. This is for promoting recovery in a short time at the time of continuing hot-rolling steel strip annealing.
[0027] The annealing temperature of a hot-rolling steel strip (board): An annealing temperature also influences greatly the RIJINGU-proof nature after cold-rolled annealing, and processability. Drawing 3 of hot-rolling finishing temperature is fixed 750 degrees C in 0.06%C, 0.3%Si, 0.5%Mn, and the high chrome steel that changed N to 0.03% and 0.008% of two levels by making Cr and 0.003%Sol.aluminum into a fundamental component 16.4%, and shows the relation between a hot-rolling coil annealing temperature, an r value, and RIJINGU height.
[0028] As shown in drawing 3, when a hot-rolling steel strip annealing temperature is 800 degrees C or less, RIJINGU height falls (improvement), and an r value goes up. When it anneals above 850 degrees C, although RIJINGU height falls, since an r value also falls and processability deteriorates, it should anneal below 800 degrees C. This aims at energy saving and can evaluate it also from a viewpoint of suppressing a manufacturing cost.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the range of the hot-rolling finishing temperature which brings about a good property, and a hot-rolling board annealing temperature.
[Drawing 2] It is drawing showing the relation between an average of r values after hot-rolling finishing temperature and cold-rolled annealing, and RIJINGU height.
[Drawing 3] It is drawing showing the relation between an average of r values after a hot-rolling board (steel strip) annealing temperature and cold-rolled annealing, and RIJINGU height.

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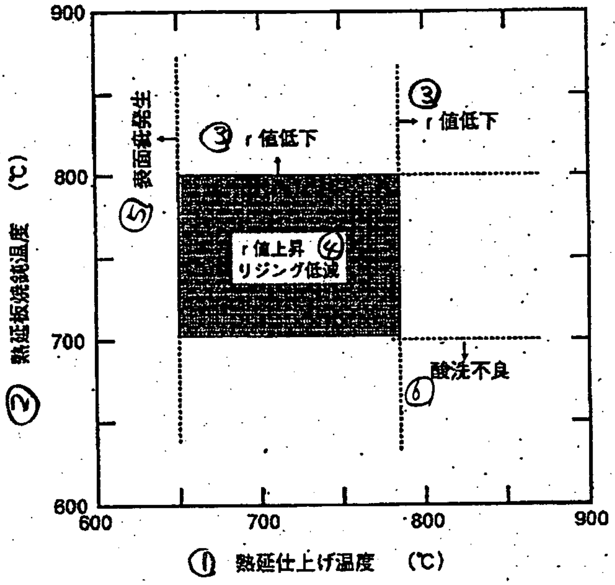
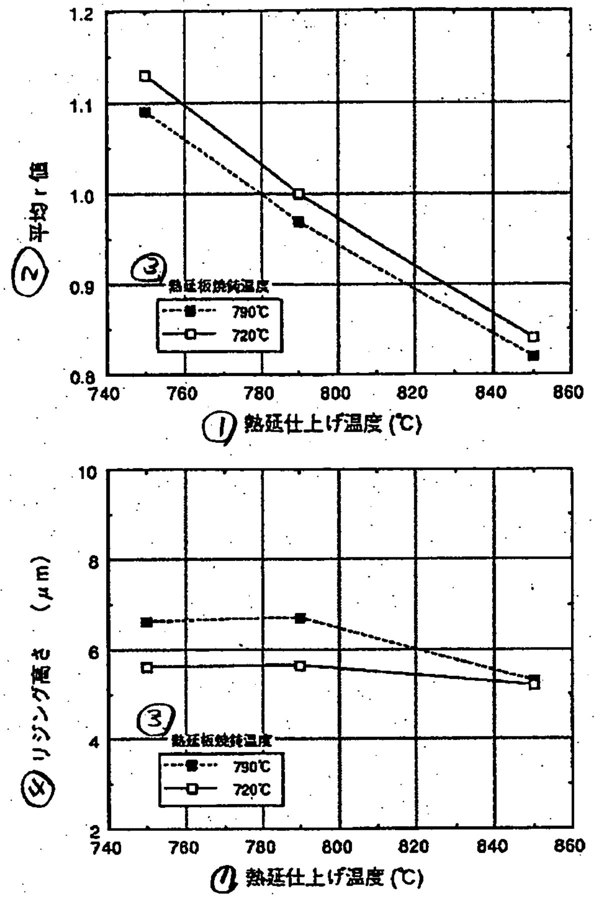
DRAWINGS

[Drawing 1]



① hot finish rolling temp. (°C)
② hot annealing temp. (°C)
③ decrease of r-value
④ increase of r-value
decrease of ridging height
⑤ occurrence of surface defects
⑥ incomplete pickling

[Drawing 2]



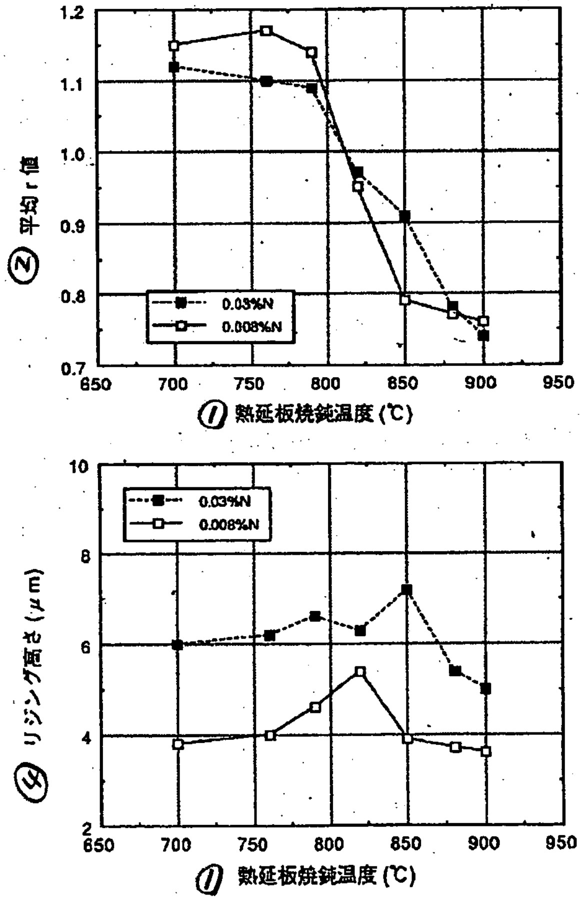
① hot finish rolling temp. (℃)

② average r-value

③ hot annealing temp.

④ ridging height (μm)

[Drawing 3]



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